

Future directions for Spatial Data Infrastructure Assessment

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19.1 INTRODUCTION

The objective of this book is to promote a better understanding of Spatial Data Infrastructure (SDI) assessment by providing the concepts, demands and implications of SDI assessments, a compilation of existing approaches to assess SDIs and examples to assist practitioners to develop more comprehensive and appropriate evaluations that fit the assessment demands. It is expected that the book contributes to the growing body of knowledge concerned with the spatial information discipline in general and SDI assessment in particular and, as such, is also useful for professionals in the SDI domain. In writing the book we aimed to cover many, if not all, of the key issues of SDI development and assessment. While we are satisfied that the book addresses many of the current issues, the editors also recognise that there are some current and evolving issues and

challenges which have not been addressed. Therefore, these evolving issues and challenges will be identified and addressed in this chapter.

The chapter first summarises the context and achievements of other chapters. Then, the issues raised will be discussed. The discussion will address a number of future issues derived from literature as well as experiences on performance management in the public sector in domains that have a much longer history of managing performance (public health and social security). The chapter then finalises with the main conclusions of future SDI assessment.

19.2 COVERING THE SDI-ASSESSMENT LANDSCAPE

The book comprises 19 chapters divided into four parts. The chapters of Part One form the theoretical backbone of the multi-view framework to assess SDIs. These chapters address the need for a broad understanding of the objectives, complexity, multi-faceted nature, dynamics and the current use of SDI in the context of SDI assessment, the demands for SDI assessments and the implications for developing a framework to assess SDIs.

Part One begins with a brief introduction of the SDI concept as an enabling platform to improve access, sharing and integration of spatial data and services in Chapter One. This chapter introduces and discusses various challenges and issues associated with current and future SDI development to support the vision of a spatially enabled government and society where location and spatial information are regarded as common goods made available to all public administrations, citizens and businesses to enhance the capability of government, and to encourage creativity and product development. Based on this, the chapter also provides a justification of the need for, and the important role of, SDI assessment.

With this in mind, Chapter Two recognises the need for SDI-assessment to support this vision but also argues that this assessment might be problematic for various reasons. First, the SDI concept is ambiguous and its understanding needs cross-disciplinary research. Other reasons are that SDIs are multi-faceted and have moving targets. The final reason is the assessment itself (including that of SDIs) is non-trivial and follows by highlighting that the development of SDIs is to cope with risks. SDI assessments must reflect the evolving learning process of their development and should emphasise discussion and dialogue between practitioners and researchers when understanding and scoping an SDI to overcome the challenges and

dilemmas that come with these complex, dynamic and multi-faceted initiatives.

Chapter Three also recognises the need for SDI assessment but argues that SDI assessment is problematic when there is not a thorough understanding of the implications for currently using the SDI. This chapter focuses on the implications of SDI use in the context of public governance and emphasises the necessity for a better understanding of the implications of SDI use to improve governance processes. Being aware of these implications justifies the need to have specific assessment approaches for the different assessment contexts; for example an assessment approach fully focusing on governance processes in the context of public governance. The chapter also presents a taxonomy system for SDI assessment, taking into account that each context (for instance public governance) is conditioned by its own set of rules and characteristics and by a unique social and organisational culture. It appears that SDI assessment approaches can be classified based on two main aspects: the degree of certainty or attainability of objectives of the SDI to be assessed and the degree of clarity (or certainty) of its potential impact. Depending on the level of uncertainty about its objectives and potential impact four possible assessment orientations can be distinguished: control assessment, assessment as learning, assessment as sense-making and exploratory assessment.

Chapter Four focuses on the current demands for assessing SDIs. It appears that routine SDI assessment is still limited despite the number of SDI initiatives that are underway worldwide. In order to explore the gap in SDI assessment, this chapter examines the institutional arrangements governing assessment demands (internal/external) and content (inputs/outputs/outcomes). On the basis of SDI assessment examples identified, this chapter suggests that budget processes are the primary assessment driver. A key reason for the gap might be that government spatial investments are seldomly categorised as ‘spatial’ so they escape routine assessment processes.

In Chapter Five the multi-view framework to assess SDIs is introduced. This framework acknowledges the difficult task of assessing SDIs due to their complex, multi-faceted, dynamic and constantly evolving nature, unclear objectives and poor knowledge about the implications of the current SDI-use and the current demands. Since SDIs can be treated as Complex Adaptive Systems, the assessment includes strategies for assessing those kinds of

systems. One such strategy is that these systems can be assessed from different views by using multiple assessment orientations, approaches and methods. It is argued that the main strengths of this assessment design lie in its wider scope, flexibility, multi-disciplinary and reduced bias in the assessment results.

Part Two is a compilation of nine approaches to assess SDIs of which the first four are currently operational to assess National SDIs. Each chapter describes one specific approach. Each approach treats SDI from a different view and context and so with a different purpose in mind.

The first approach is the SDI Readiness (Chapter Six). This approach strongly focuses on pre-existing conditions to undertake SDIs in the countries assessed and makes use of a fuzzy-based model supported by a multivalent logic system. The resulting SDI Readiness Index is defined as a composite assessment of the capacity and willingness of countries to use SDIs considering the following key SDI-factors: organisation, information, human resources, technology, and financial resources.

The second approach is the clearinghouse suitability (Chapter Seven). This approach focuses on national spatial data clearinghouses which can be considered as one of the key features of a national SDI. The resulted suitability index is defined as a measurement of the quality and performance of this electronic facility.

The third approach is the INSPIRE State of Play (Chapter Eight). This approach has been initiated to support a political process, that is to guide the preparation and implementation of the INSPIRE Directive which aims at building a European SDI. It focuses on key SDI components in the context of INSPIRE directive (organisation, legal framework and funding mechanism, geographic data, metadata, access services and standards) with the use of indicators. The main results are (change) assessment matrices with indicator results and country reports.

The fourth approach is assessing the SDI from an organisational perspective by using different maturity stages (Chapter Nine). This approach focuses on the classification of SDIs into the four stages of SDI development from an organisational perspective: stand alone/initiation, exchange/standardisation, intermediary and network. This classification is based on the presentation or performance of the following SDI characteristics: vision, leadership, communication channels and self-organising ability.

The fifth approach is assessing the SDI based on a framework originally developed for land administration systems (Chapter Ten). This approach focuses strongly on measuring indicators determined for five assessment areas: policy level, management level, operational level, other influencing factors and assessment of performance. The SDI components of policies, standards, access networks, people and data are mapped into the assessment areas mentioned. In order to make this approach for SDI effectiveness and efficiency operational, it is recommended to do more in-depth applications of the assessment areas and further develop the indicators specific to the SDI being assessed.

The sixth approach is SDI Performance Based Management (Chapter 11). This systematic approach is based on one technique that facilitates infrastructure practitioners to operate an infrastructure in such a manner that its strengths and weaknesses are constantly identified, analysed and managed. It is an approach to performance improvement through an ongoing process of establishing strategic performance objectives and measuring performance using indicators. It is, in potential, a good tool for managing an SDI in a manner that facilitates regular assessments of its components as well as supporting the effective and efficient implementation of the components. In order to make this approach operational, developing a framework for key performance indicators is recommended.

The seventh approach is assessing the SDI from an organisational perspective using metaphors (Chapter 12). This approach focuses on classifying SDI organisations into paradigms (functionalist, interpretative, radical structuralist, radical humanist) and metaphors (organism, machine, domination, culture). This classification is based on organisational theories.

The eighth approach is the legal approach to assess SDIs (Chapter 13). This approach focuses on the legal framework necessary for developing a well-functioning SDI. The assessment is not based on empirical evidence but makes use mainly of legislation, case law and jurisprudence. The assessment distinguishes three levels of legal assessment: compliance, coherence and quality.

The ninth approach is SDI effectiveness from a user perspective (Chapter 14). This approach focuses on the effective use of SDIs by identifying the current and potential users and finding out how useful is the SDI supplied data and services for their particular needs. It can be considered to be a kind of reality check for SDI developers to be

aware that an infrastructure is only as good as it serves the broad set of (potential) users at various levels. In order to make this assessment approach operational it is strongly recommended to determine contextual factors and outcomes. Those variables represent processes and elements that can be changed to support furthering of SDI use and usefulness.

Part Three is a compilation of three practical examples of SDI assessment initiatives at different administrative levels, each developed for a specific demand and the results of the first attempt to apply the multi-view framework to assess SDIs. The examples represent actions taken partly on the basis of our understanding of the knowledge and context for SDI assessment and further show that the demand for SDI assessment is growing and as scope widens, many practitioners struggle to find the right indicators.

The first example is the National SDI (NSDI) assessment for developing countries (Chapter 15). Being aware that many developing countries are also initiating NSDIs, so far their efforts are not assessed systematically. To address this gap, an SDI assessment project was initiated which selected a common set of measurable key variables using case studies, literature and expert knowledge. The final result is a set of 14 key variables for NSDI assessment in developing countries.

The second example is the INSPIRE Implementing Rule for Monitoring and Reporting (Chapter 16). According to the INSPIRE Directive, Member States shall organise the continuous monitoring of the implementation progress with respect to the targets set out by INSPIRE. One drafting team is working to develop an operational monitoring mechanism for Member States using literature, workshops, expert knowledge, feasibility tests and stakeholder consultations. The final result is an implementation rule that defines how Member States must provide the results of the monitoring to the Commission and make them accessible to the public.

The third example is the Dutch initiatives for assessing SDIs (Chapter 17). This example clearly illustrates the changing demands influencing SDI assessment. In The Netherlands a trend can be observed from a more intuitive to rational assessment, reflecting the improved understanding of SDI over the years.

Chapter 18 then presents the results of the first attempt to apply the multi-view framework to assess SDIs. The four operational approaches (SDI readiness, clearinghouse suitability, INSPIRE State of Play and SDI assessment from an organisational perspective using

different maturity stages) were applied to assess 11 NSDIs. The results of this assessment were analysed in order to test the validity of the developed multi-view framework. The results confirm the validity of assessing NSDIs from multiple views, however more detailed research is strongly needed.

Part Four (Chapter 19 being this chapter) reviews all the chapters of the book, highlights many issues facing the development of SDI assessments and concludes with a discussion on the future directions for assessing SDIs.

By exploring the current SDI assessment landscape, we can conclude that the SDI assessment is still in its infancy in the sense that it is still difficult to examine how it develops over time. So far, we are not able to see that certain temporal patterns or sequences are common or not. What we can see is that the approaches become more extensive, comprehensive, user-oriented, demand-driven, diverse and more closely tied to explicit targets.

19.3 SDI ASSESSMENT ISSUES

In SDI assessment, three critical questions should be asked before starting the actual assessment. The first question concerns the user of the SDI assessment. A policy-maker is interested, and requires, different information from an assessment than a politician responsible for an SDI. A distinction needs to be made between those operating at the strategic, management or operational level (see Figure 19.1).

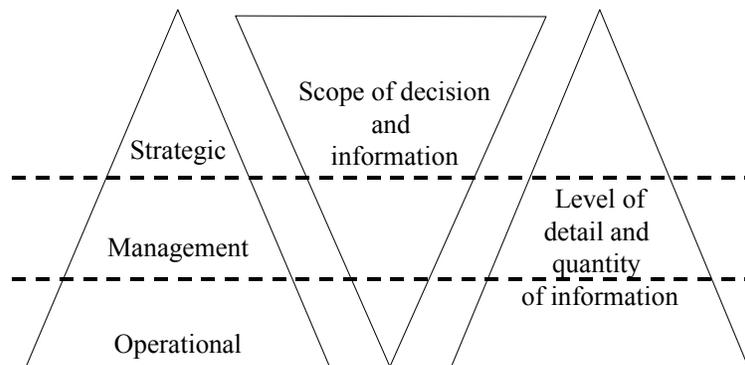


Figure 19.1: Relation between organisational tier, the accompanying scope of decision and information, and the detail of necessary information (see Bemelmans 1994)

The second critical question will be about what is going to be assessed. Closely related is the third question which concerns the level of SDI that is being assessed. It is evident that a decision-maker at a global level requires different assessment methods than one operating at the local level.

Depending on the user, the use and the level of SDI, the SDI assessment approach needs to be selected. This approach may very well be one of the approaches presented in this book.

An assessment may be to compare different SDIs at a certain level and is what the monitoring of INSPIRE will partly focus on. At a national level, such an approach may also be beneficial for policy makers responsible for their NSDI, for example to use it as a promotion for their SDI (for instance, ‘we are number one’), or to use it as a tool to convince decision-makers to invest in their SDI (such as ‘we are even worse than country X’).

At a lower level, SDI assessment should not focus so much on the strategic issues but much more on the operational levels — what should be done to further stimulate SDI development. In this respect, the assessment should be accomplished relative to the objectives that were agreed upon by the stakeholders and for this SDI.

Each of these aspects is of critical importance when choosing the SDI assessment instrument and for the outcome of the assessment.

19.4 SDI ASSESSMENT DEVELOPMENT ISSUES

As individual chapters have identified, there are a number of important issues related to SDI-assessment; from conceptual, technical, socio-technical, political, legal, institutional and financial perspectives. Following are some future issues that practitioners may need to consider when assessing SDIs in the long-term in order to achieve the sustainable and ongoing development of SDIs. These issues are mainly derived from a body of knowledge and experiences relating to performance assessment activities in the public sector (for example public health and social security) which already has some history. From this it appears that certain temporal patterns, or sequences, are quite common and might be also applicable when assessing SDIs.

It is likely that SDI assessment will become ‘performance’ focused for public management and policy. However, the way in which SDI assessment will be performed is uncertain. For instance,

Will there be a way that is the most dominant? How are the strategies in the different countries evolving? According to Ingraham et al. (2000) ‘performance must become a way of life and a critical part of the culture’ of the public sector in the future. On the other hand, the question is not how useful is SDI-assessment? The research has become: how tenable is the management cycle that underlies the management by assessing SDI-development? In any case, implementing assessment approaches requires time for ‘building a track record’ (Broom, 1995). It appears that several performance challenges (mixed responsibilities, varied objectives and indicators) and implementation problems have resulted in considerable suspicion about performance as a driver for public management (Bouckaert and Halligan, 2007).

If we consider SDI assessments as just another new example of performance management, then we can expect the following based on Pollitt (2007):

- the community of SDI assessors will be bigger;
- the growing SDI assessment community will include a wide range of disciplinary approaches. The community of discourse will contain inter alia spatial scientists, political scientists, generic management specialists, sociologists, economists, statisticians and public administration scientists;
- the foci of the specific interest will broaden. The SDI assessment will range from high level studies of how politicians use the results, through to middle level accounts of how managers address frameworks of assessment indicators to detailed studies of how staff may game and pervert or suffer stress and alienation from indicators. The SDI assessments will also stretch from rather prescriptive advice on ‘how to do it better’ to highly detached academic interpretations and deconstructions. It will be very difficult for any single individual to command expertise right across this tremendous panorama of literature;
- information and communication technologies will support and sometimes shape the assessments. For example, there are studies of how new ICTs may facilitate the collection and dissemination of SDI assessment information (Viganó and Millot, 2008a;b;c);
- the current assessment studies will be complemented with field studies of how the assessment approaches are used (or not used) by practitioners;

- the need of SDI assessment should be closely coupled to significant community incentives (rewards and/or punishments) before it will have much effect on operational decision-making;
- the community continues to focus on better approaches that are more valid and reliable. Another important topic that the assessment community will deal with is the need to shift from input and process assessment to output assessment, and beyond that, to outcome assessment, and to citizens' reaction to those outcomes in the form of satisfaction and/or trust (Bouckaert, 2006). The community will also worry about the preserve incentives which assessment approaches can inadvertently create, and the political environment which take place around these approaches; and
- it remains difficult to demonstrate that investments in SDI assessment improve the SDI development. This does not mean that SDI assessment will fail to generate improvement rather it suggests that many of the investments in SDI assessment will be acts of faith rather than rational calculations.

So far the chapter looked at how the SDI assessment community is expected to develop over time; the next question is how the SDI-assessment approaches are expected to evolve. On the basis of literature (Pollitt, 2008; Pollitt et al., 2008; Bouckaert and Halligan, 2007) and experiences relating to performance management activities in the public sector, we might expect both cycles (issues which go round and round, or alternate) and arrows (issues which fly forward on a particular trajectory), or might expect some quite stable paths but also sudden punctuations or windows of opportunity. In short, various combinations of all of the following can be expected:

- *Culturally-shaped 'paths'*. The administrative culture may shape how assessments are used or indeed whether they are used at all. In countries such as Australia, Canada, USA SDI assessments are widespread and aggressively used linked to various types of incentives and sanctions (see examples of chapter four), meanwhile in other countries they do not exist.
- *Steady, incremental development*. This refers to gradual assessment shifts of focus on inputs and processes to outputs and finally outcomes. The Geo-connections Logic Model (Canada) is one of the first SDI assessment examples that

already include outcomes in the assessment (see chapter four and 11).

- *Patterned alternations.* This refers mainly to regular changes within the indicator sets of the approach. Sometimes the changes are small (the technical definition of an indicator is changed slightly) or bigger (indicators are dropped altogether and new ones introduced). Either way, such changes degrade the possibility for time series. An example of this change happened in the INSPIRE State of Play approach which introduced two new indicators in 2006: Transformation services and Middleware services.

It will be no surprise that future SDI-approaches will change their indicators, since there are a number of reasons why indicators may be altered. One good reason is that the experts learn from their attempts to assess, and frequently want to replace an existing indicator with one that is more comprehensive. Another reason is that shifts in public and political attention may lead to indicators being added. A third reason is that new procedures or technologies are introduced which require new measures for assessment (web services were not being assessed in the 1990s). A fourth is that an indicator just becomes irrelevant, is altered or dropped. Future examples of this might be the legal indicators of the INSPIRE State of Play. A fifth is that there may be a tendency to cycle from many indicators to few. As assessment approaches become increasingly sophisticated more and more indicators are added, in an attempt to capture the full (extent of the) infrastructure. However then the whole of the approach becomes very complex and opaque and reformers will appear to simplify to a few key (complex and composite) indicators.

19.5 CONCLUSIONS AND FINAL REMARKS

This chapter has summarised the main conclusions of the book and identified some key issues which need to be considered in future SDI assessments.

However what does the book contribute to our understanding of SDI-assessment? We believe this contribution is highlighted by three themes that are reflected in the book. These are (1) the discussions surrounding the concept of SDI-assessment; (2) the existing research associated with the SDI-assessment and (3) on how theory can contribute to SDI-assessment in practice.

The book adopts a broad scope of assessing SDIs, recognising the many views of SDI assessment and that SDI assessment is evolving. It has identified potential drivers and dilemmas which are currently influencing the development of SDI assessment and explores in depth the importance of a user focus, recognising what happens in practice. While SDI assessment is challenging to SDI developers, the book has attempted to provide some support to better understand SDI assessment.

It appears that what is valid for performance management in other public domains is likely to be applicable for SDI assessment as well. It is also likely to be shaped by prevailing cultures, by accidents and scandals and other foreseen events.

SDI assessment is likely to have developmental trajectories over time. Some approaches and their indicators will wear out, or become obsolete, for a whole variety of reasons. Behaviours will adapt to the presence of particular assessment regimes, not only to game with them, but also by learning to live with them.

In virtually every case, however, we observe that SDI assessment regimes cannot stand still. The assessments are subject to endogenous and exogenous pressures which lead to change. Sometimes this is incremental, sometimes transformational. Accordingly, also the objectives of the SDI and, the relevant indicators of SDI assessment, may change.

It should be noted that the objectives of the SDI, and the purpose and user of the assessment, are key to the selection of the SDI assessment method(ology). The design of the multi-view framework, as presented in this book, is such that it is flexible to different future views, strategies, approaches, developmental trajectories and assessment regimes; and that it might be applicable in different cultures. It is likely that the results of multi-view framework applications continue to be more comprehensive, realistic and less biased.

REFERENCES

- Bemelmans, T.M.A. (1994). Bestuurlijke informatiesystemen en automatisering, Deventer: Kluwer bedrijfswetenschappen.
- Bouckaert, G. (2006). The public sector in the 21st century: renewing public sector performance measurement, *Köz-Gazdaság*, I:1, pp. 63-79.
- Bouckaert, G. and J. Halligan (2007). *Managing performance: international comparisons*, London, Routledge/Taylor & Francis.
- Broom, C.A. (1995). Performance-Based Government Models: Building a Track Record, *Public Budgeting & Finance*, 15(4): 3-17.
- Ingraham, P., Coleman, S.S. and D.P. Moynihan (2000). People and Performance: Challenges for the Future Public Service, The Report from the Wye Rive Conference, *Public Administration Review*, 60: 54-60.
- Pollitt, C. (2007). Who are we, what are we doing, where are we going? A perspective on the academic performance management community, *Köz-Gazdaság*, II:1, pp. 73-82.
- Pollitt, C. (2008). *Time, policy, management: governing with the past*, Oxford, Oxford University Press.
- Pollitt, C., Harrison, S. Dowswell, G., Bal, R. and S. Jerak-Zuiderent (2008). Performance indicators: a logic of escalation, Proceedings European Group for Public Administration Conference, September, Rotterdam.
- Viganó S. and M. Millot (2008a). Compliance Testing and Interoperability Checking: Metadata State of Play. Ispra, Italy: Joint Research Centre (European Commission), JRC Scientific and Technical Reports.
- Viganó S. and M. Millot (2008b). Compliance Testing and Interoperability Checking: Data State of Play. Ispra, Italy: Joint Research Centre (European Commission), JRC Scientific and Technical Reports.
- Viganó S. and M. Millot (2008c). Compliance Testing and Interoperability Checking: Services State of Play. Ispra, Italy: Joint Research Centre (European Commission), JRC Scientific and Technical Reports.